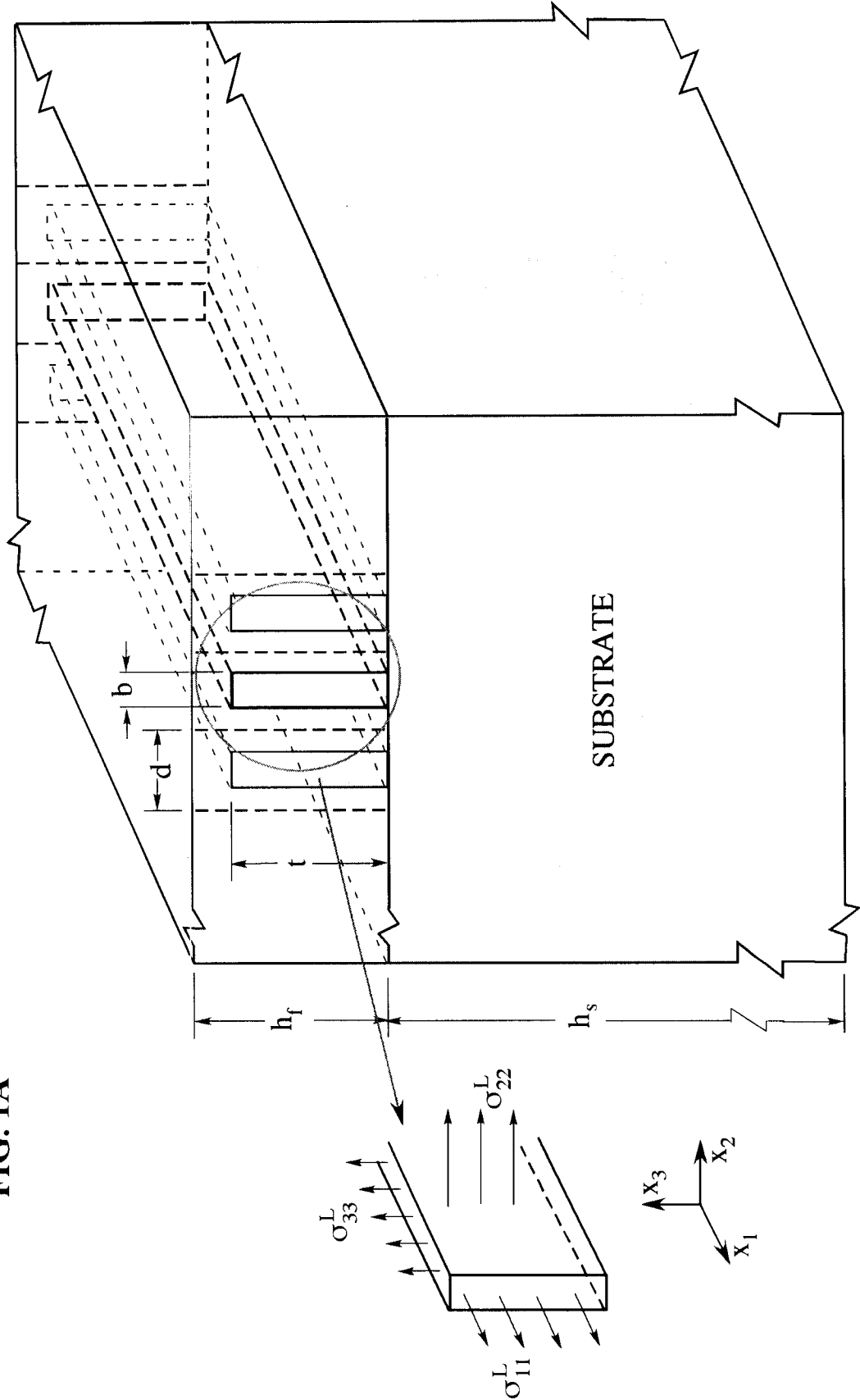


FIG. 1A



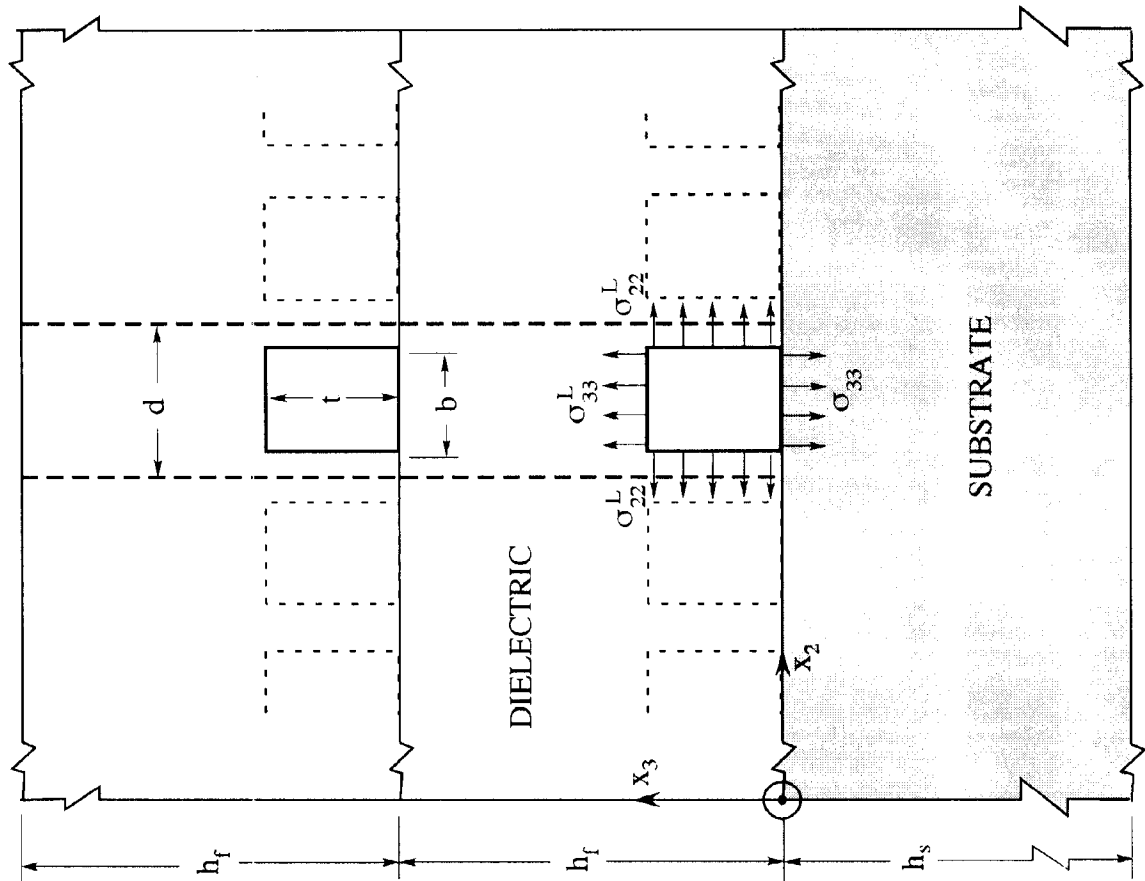
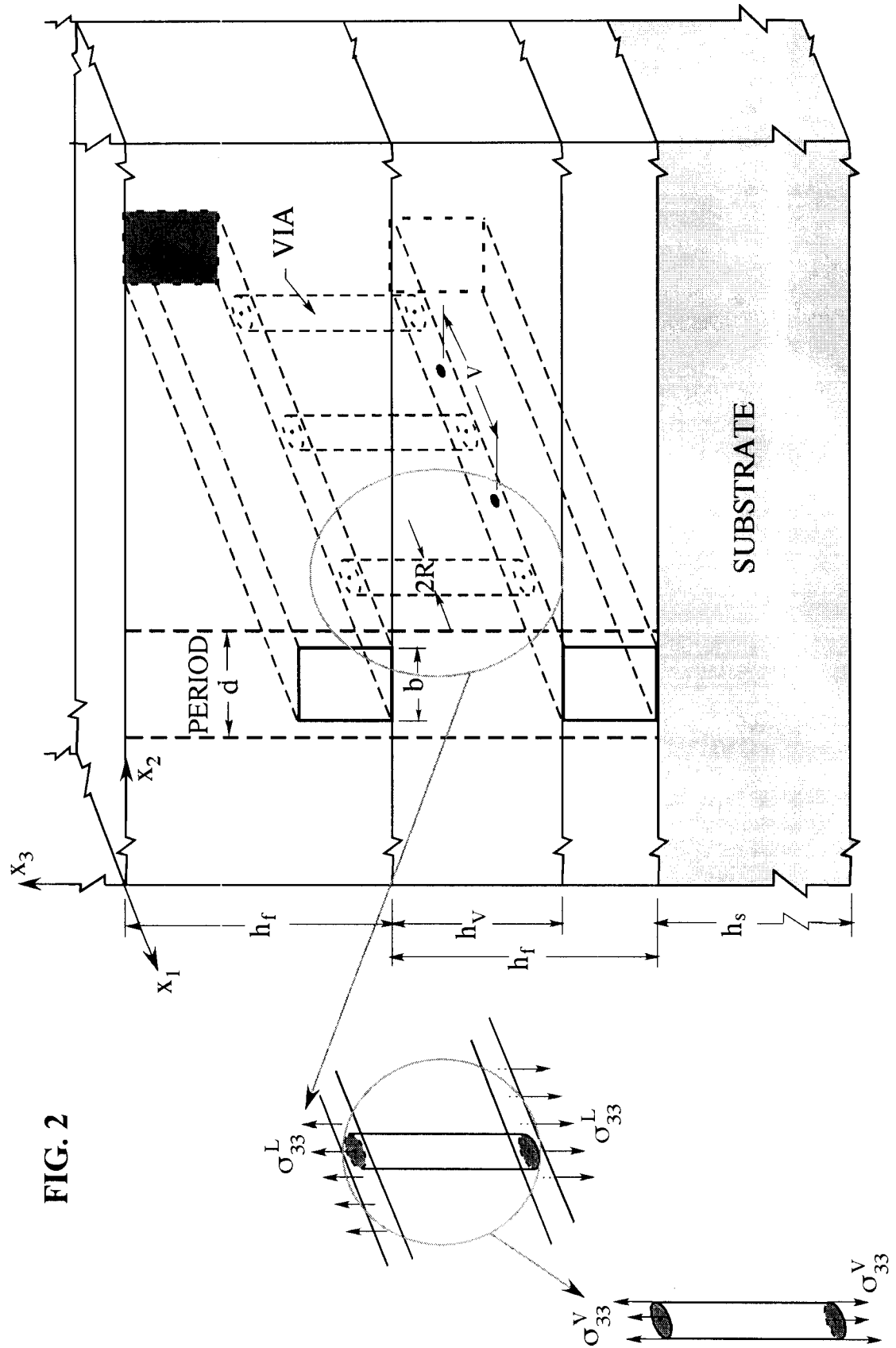


FIG. 1B



VIAS: AMPLIFICATION FACTORS

$E_{Cu}=110\text{GPa}, \alpha_{Cu}=17\times 10^{-6}/^{\circ}\text{C}$
 $E_W=410\text{GPa}, \alpha_W=4.3\times 10^{-6}/^{\circ}\text{C}$

$E_{TEOS}=59\text{GPa}, \alpha_{TEOS}=1\times 10^{-6}/^{\circ}\text{C}$
 $E_{SILK}=2.45\text{GPa}, \alpha_{SILK}=66\times 10^{-6}/^{\circ}\text{C}$

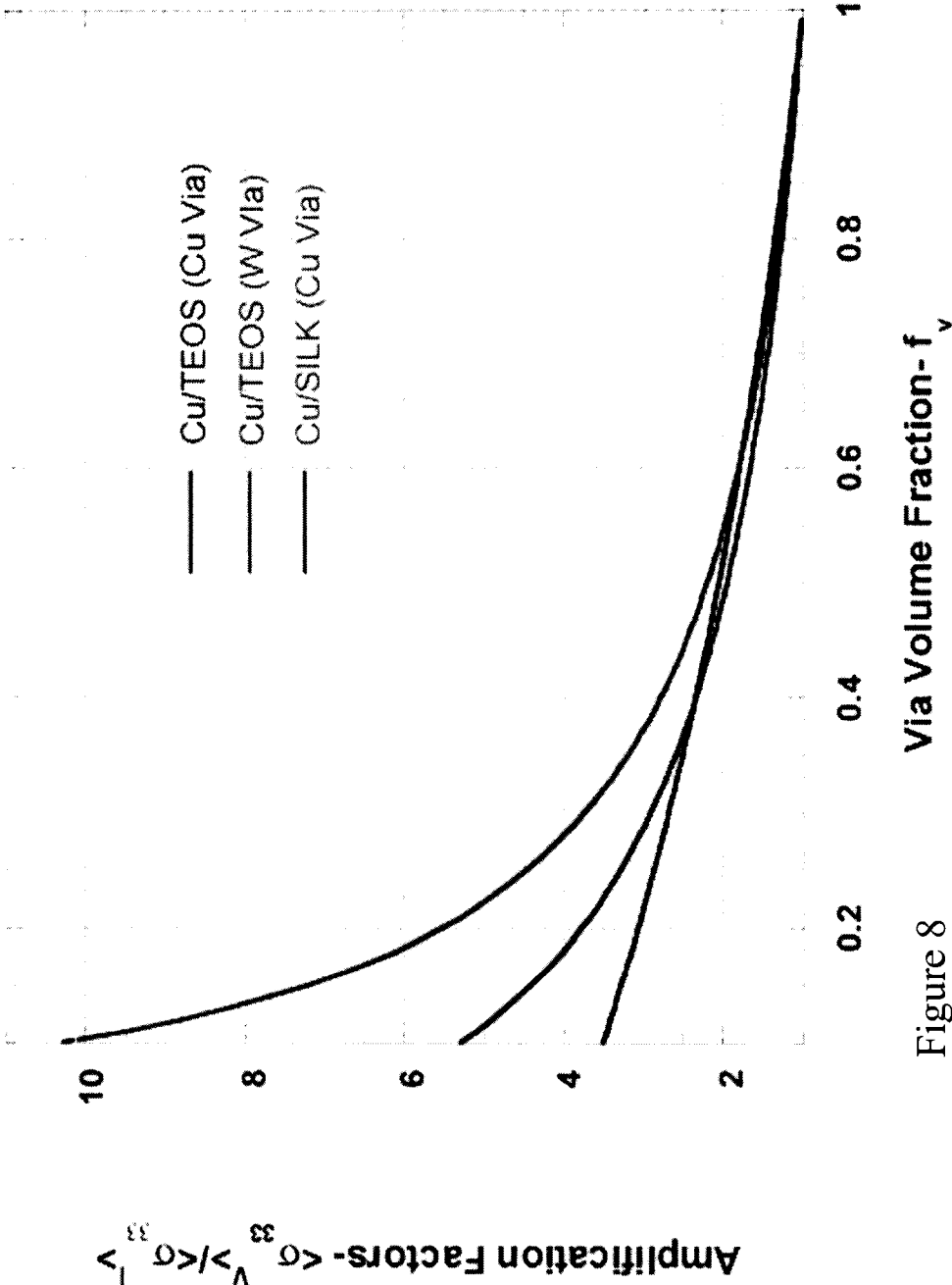
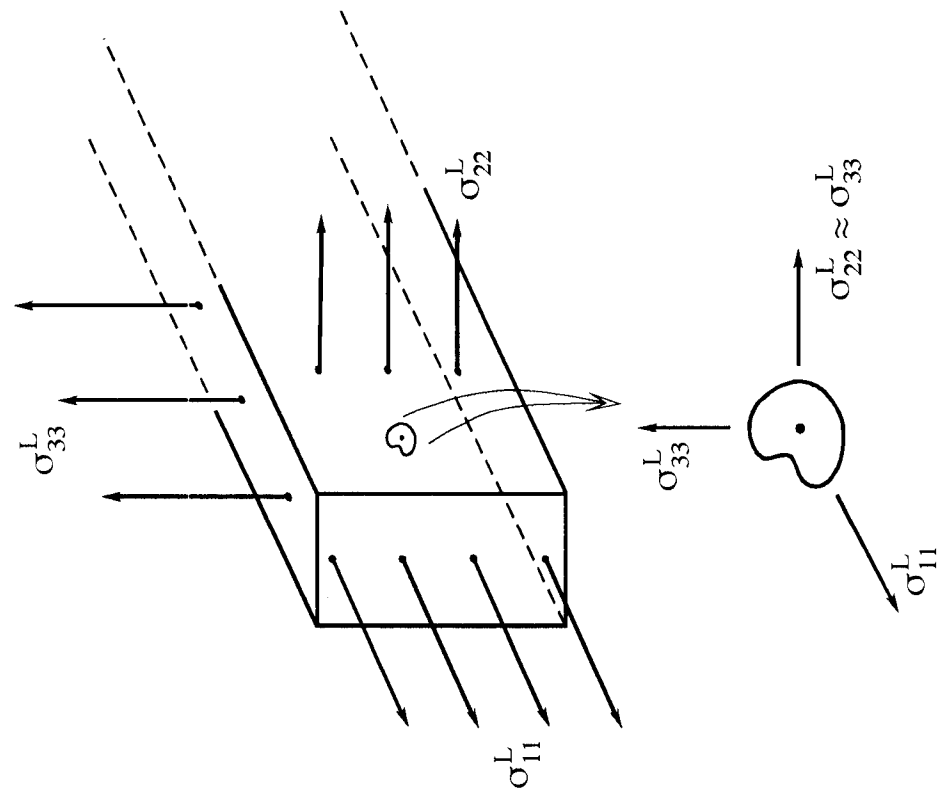


Figure 8

FIG. 4



Materials: Cu lines, TEOS dielectric, Si Substrate
Geometry: $t=0.5\mu\text{m}$, $h_s=525\mu\text{m}$, $b=0.4\mu\text{m}$, $f_l=b/d$
Criterion: $\alpha=2$ or 3 , $\sigma_y=293\text{MPa}$ (using Hall-Petch)

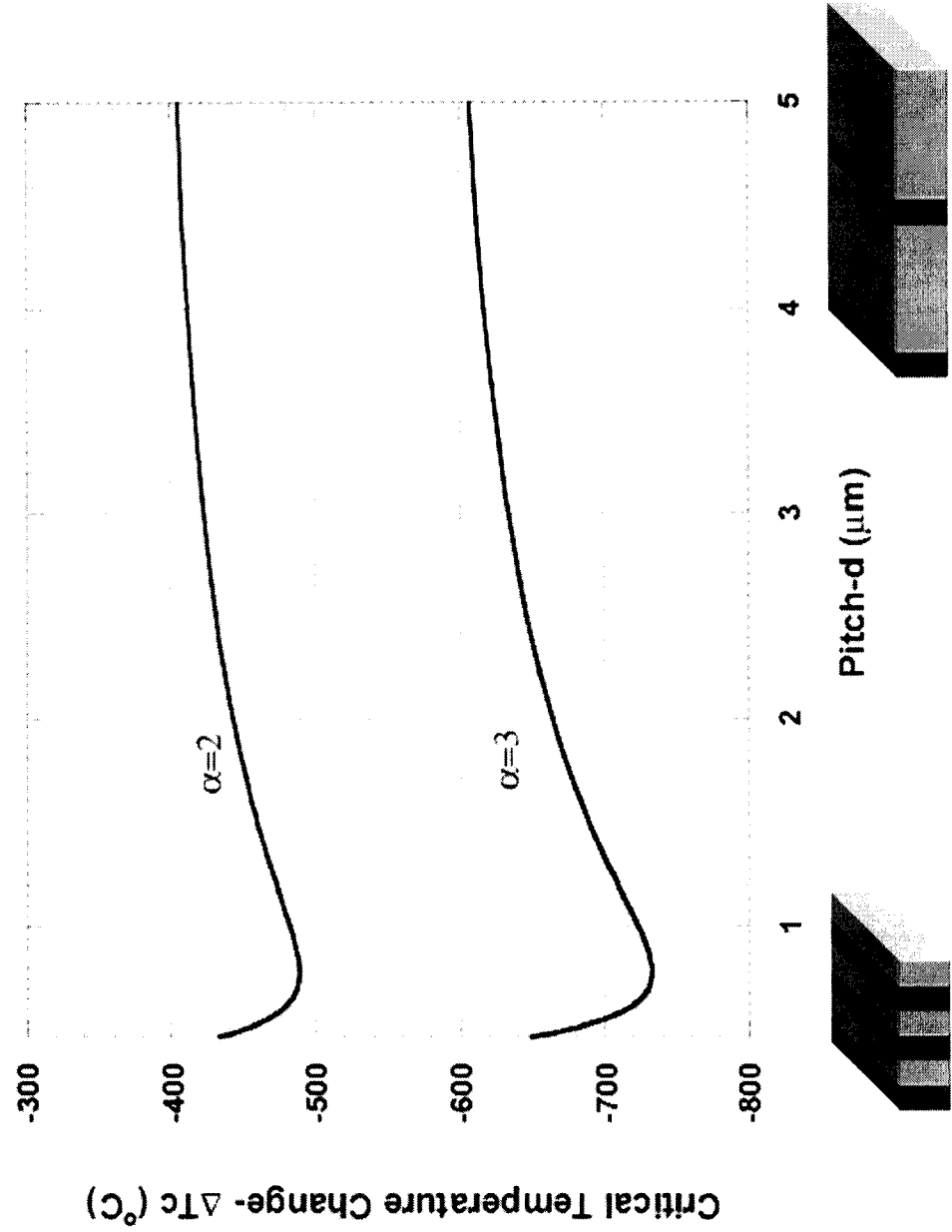


FIG. 5

FIG. 6

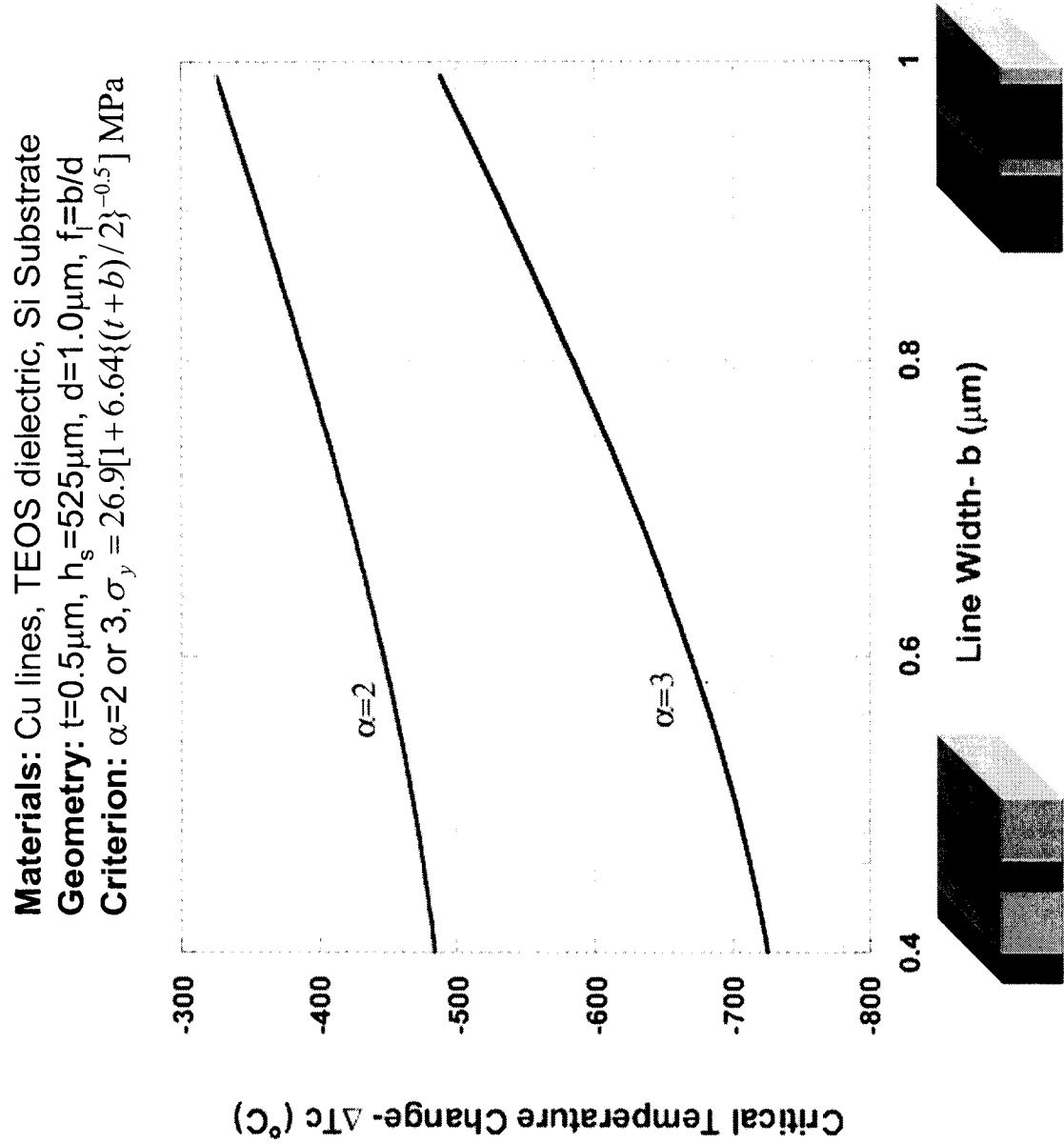


FIG. 8

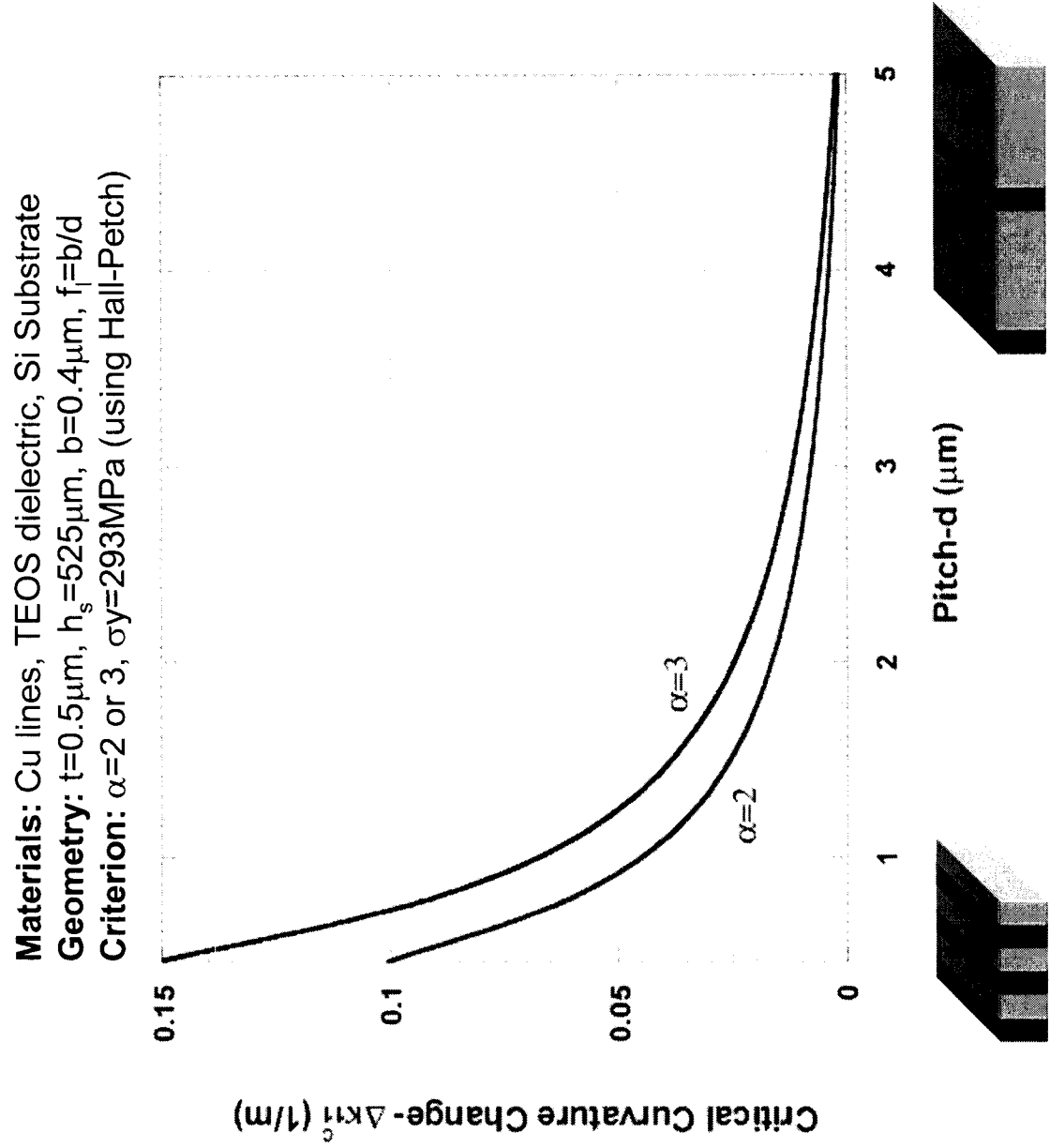


FIG. 8

Materials: Cu lines/vias, TEOS dielectric, Si Substrate
Geometry: $t=0.5\mu\text{m}$, $h_s=525\mu\text{m}$, $f_l=b/d=0.5$, $V=2.5\mu\text{m}$, $f_v=\pi R^2/bV$
Criterion: $\alpha=3$, $\sigma_y=293\text{MPa}$ (using Hall-Petch)

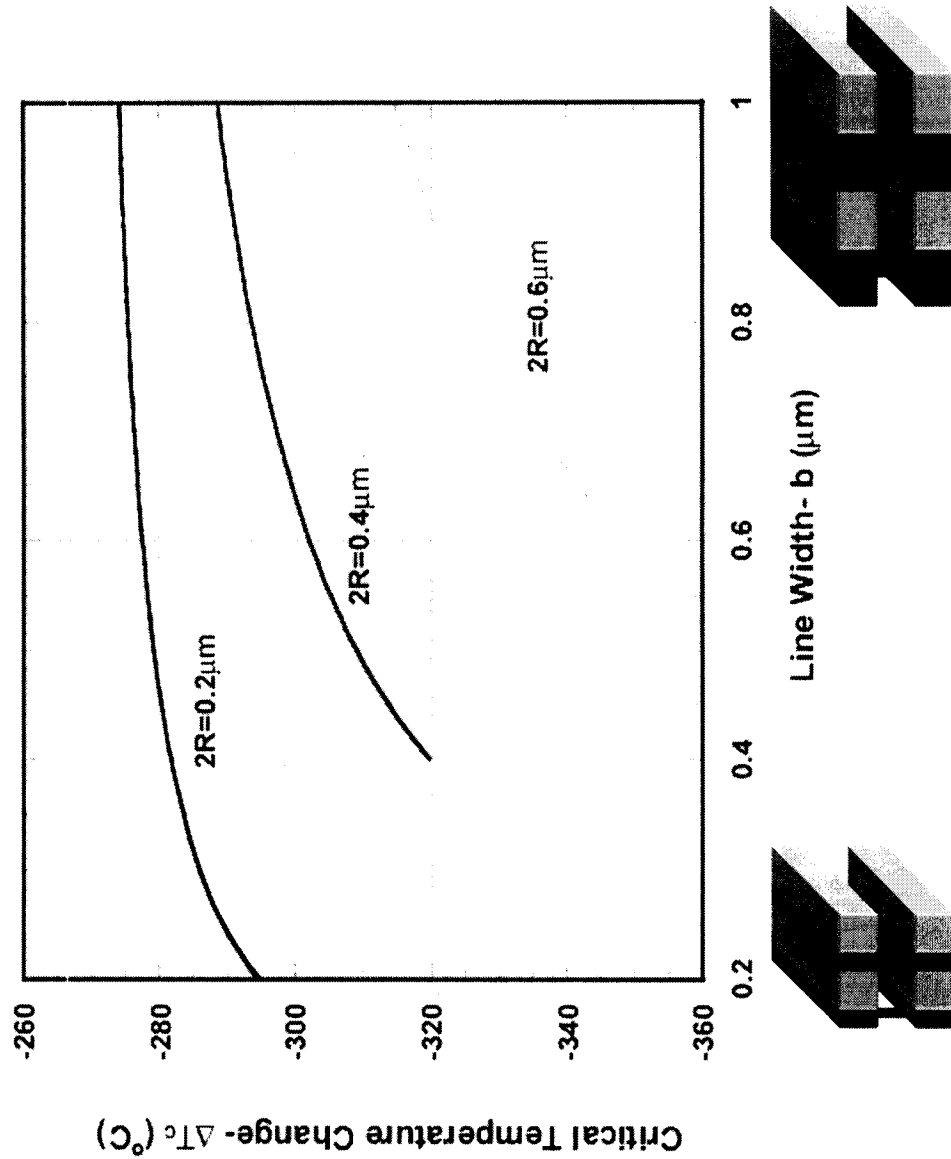


FIG. 9

Materials: Cu lines/vias, TEOS dielectric, Si Substrate
Geometry: $t=0.5\mu\text{m}$, $h_s=525\mu\text{m}$, $f_l=b/d=0.5$, $2R=0.4\mu\text{m}$, $f_v=\pi R^2/bV$
Criterion: $\alpha=3$, $\sigma_y=293\text{MPa}$ (using Hall-Petch)

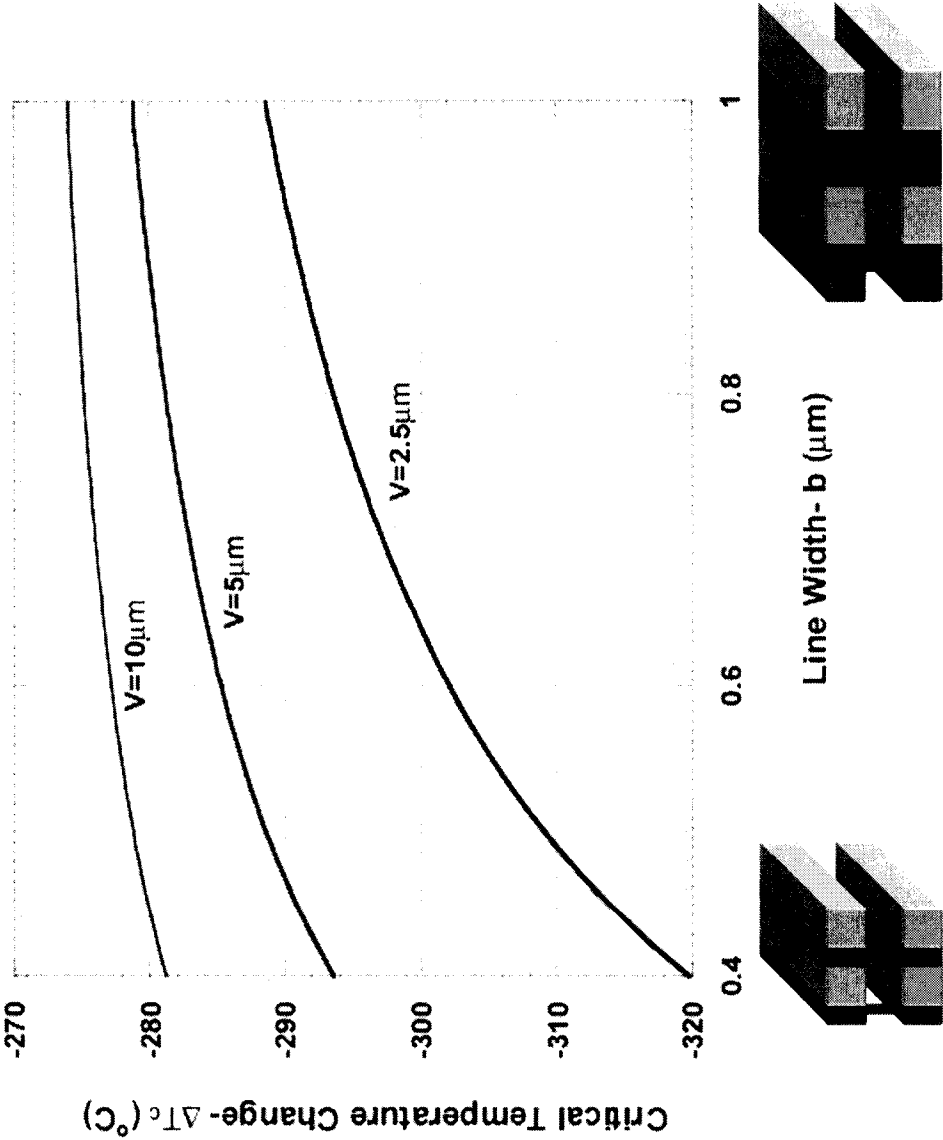


FIG. 10

Materials: Cu lines/vias, TEOS dielectric, Si Substrate
Geometry: $t=0.5\mu\text{m}$, $h_s=525\mu\text{m}$, $f_l=b/d=0.5$, $V=2.5\mu\text{m}$, $f_v=\pi R^2/bV$
Criterion: $\alpha=3$, $\sigma_y=293\text{MPa}$ (using Hall-Petch)

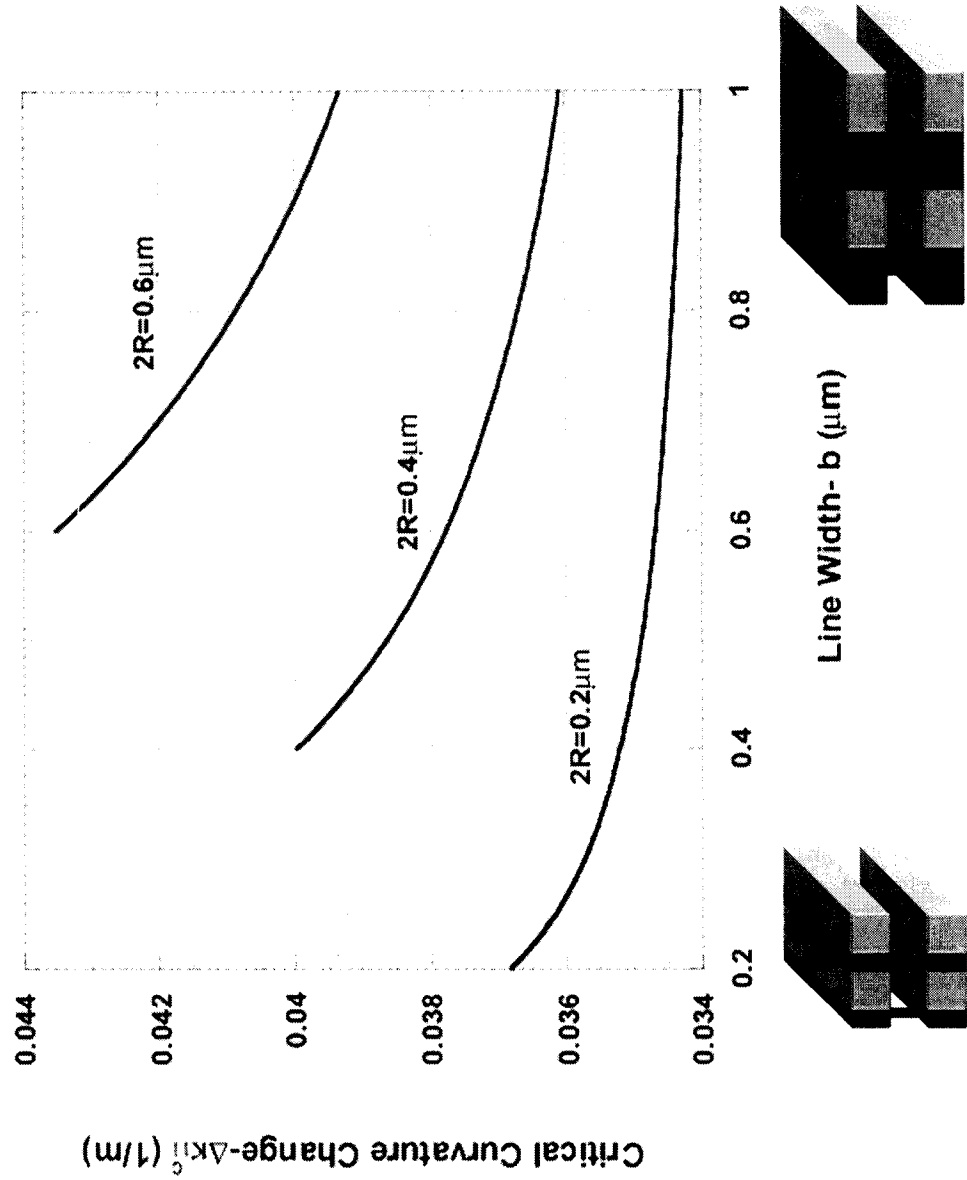


FIG. 11

Materials: Cu lines/vias, TEOS dielectric, Si Substrate
Geometry: $t=0.5\mu\text{m}$, $h_s=525\mu\text{m}$, $b=0.4\mu\text{m}$, $f=b/d$, $2R=0.4\mu\text{m}$, $V=2.5\mu\text{m}$, $f_v=\pi R^2/bV=0.125$
Criterion: $\alpha=3$, $\sigma_y=293\text{MPa}$ (using Hall-Petch)

